Surface Water Quality Objectives

Interim Edition

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Saskatchewan
Environment

Foreword

The ***Surface Water Quality Objectives*** (EPB 356, July 2006) were adopted and modified from the ***Canadian Environmental Quality Guidelines*** (CCME, 1999). Since the CCME is currently revising their protocols for the derivation of water quality guidelines these objectives are now being published as an 'Interim Edition'.

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http://www.se.gov.sk.ca/environment/protection/water/surface.asp

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1.0 Introduction

This document replaces the publication ***Surface Water Quality Objectives*** (MB #110, August 1997) and its earlier printings and editions.

Water quality objectives are developed to provide basic scientific information about the effects of water quality variables on potential water uses such as recreation, agriculture, industrial and municipal water supplies, and aquatic life. The objectives are important tools which, when used in a framework of provincial and federal environmental assessment, risk management, and the application of best available treatment technology, support the management, protection and enhancement of the surface water resources of the province. Those charged with developing objectives (federal, provincial and territorial governments, as well as water management agencies such as the Prairie Provinces Water Board) must decide what uses are to be protected, obtain the necessary information, formulate the objectives, and present them for approval to the appropriate jurisdiction. Ongoing, periodic revisions to the surface water quality objectives are necessary to ensure that new scientific findings are routinely incorporated and that emerging approaches to enhanced environmental protection are considered. In recent years, much new scientific information has emerged that warrants consideration.

Water quality objectives have been established for Saskatchewan surface waterbodies as part of Saskatchewan Environment's (SE) mandate to manage, enhance and protect this province's natural and environmental resources including air, water and soil. One of the first major steps in the development of water quality objectives in this province was the publication of ***Water Quality Criteria*** by the Saskatchewan Water Resources Commission in 1970. ***Water Quality Objectives*** (1975) was essentially a reprint of the 1970 document with some minor revisions. The criteria in these early publications were the main values used to evaluate water quality until 1987, when the Canadian Council of Resource and Environment Ministers (CCREM) released the ***Canadian Water Quality Guidelines*** (CCREM, 1987). The Saskatchewan objectives were subsequently revised and updated in 1988 based largely on the information provided in the CCREM document and were published as ***Surface Water Quality Objectives*** (WQ 110 - November 1988). The document ***Surface Water Quality Objectives*** (MB#110, August 1997) was a reprint of the 1988 booklet and was changed mainly with respect to updating the names, addresses and telephone numbers of agency contacts.

In April 1996, the Deputy Minister's Committee of the Canadian Council of Ministers of the Environment (CCME) gave its approval for the Water Quality Guidelines Task Group to work towards assembling an integrated ***Canadian Environmental Quality Guidelines*** document to be presented to the Ministers. The resulting document was published in 1999 and builds on the highly successful release of the ***Canadian Water Quality Guidelines*** in 1987, which provided national environmental quality guidelines for a number of water resource uses. The 1999 publication is the most comprehensive compendium of its kind in Canada and the world - including a wide range of environmental quality and human health guidelines for water, soil, sediment, tissue and air - and is the basis for the current version of the Saskatchewan objectives.

The ***Surface Water Quality Objectives*** will be revised on a continual basis in the future as new scientific information emerges and as further experience is gained in applying the objectives.

2.0 Approaches to Guideline Derivation

The ***Surface Water Quality Objectives*** are numerical concentrations or narrative statements that have no legal standing, but instead serve as a guide for issuing permits, licenses and orders, and as a means of supporting and maintaining designated water uses. While the objectives take into consideration that healthy aquatic ecosystems can tolerate some stress and can recover, where water bodies are considered to be of exceptional value it is a generally accepted policy that degradation of the existing water quality should always be avoided.

For the 2006 version of the ***Surface Water Quality Objectives – Interim Edition***, the province has decided to directly adopt the generic CCME Guidelines for the protection of aquatic life, agricultural and recreational uses for all watersheds in the province unless the following criteria arise:

1. the generic guideline for a substance is lower than the upper limit of background data – there are some waterbodies in Saskatchewan where natural or background levels of certain constituents regularly exceed the existing objectives. For example, natural levels of sodium in the Carrot River often exceed the guideline for irrigation. In situations like this, basin- or watershed-specific objectives may be developed on a case-by-case basis; or,
2. the toxicity of a substance is dependent on a receptor (e.g. brown trout) or environmental factor (e.g. water hardness, pH, etc.) that would not typically be found in Saskatchewan.

If one of the these conditions exists, and sufficient water quality data is available for the watershed, then the province will review the generic objectives using procedures outlined in the CCME document ***Guidance on the Site-Specific Application of Water Quality Guidelines in Canada: Procedures for Deriving Numerical Water Quality Objectives*** (2003). The 'Background Concentration Procedure' recommends using the mean value obtained for a specific parameter and then adding two standard deviations to obtain the upper limit for that parameter. If the upper limit is greater than the generic objective, then a site- or watershed-specific objective should be developed.

There are many instances where the natural water quality of a lake or river does not meet some of the objectives. In these cases, the objectives obviously will not apply. It should be noted, however, that where the natural existing quality is inferior to desirable objectives, it would be unwise to permit further deterioration by unlimited or uncontrolled introduction of pollutants. Naturally occurring circumstances are not taken into account in these "objectives" and due consideration must be given where applicable (eg. spring runoff effect on colour and odour; ice and snow cover effect on dissolved oxygen; and, rainfall influences on bacteria levels in surface waters).

3.0 Objectives for Effluent Discharges

3.1 General Objectives

The following basic objectives are applicable to all waters receiving effluents, **including the mixing zones adjacent to effluent outfalls** (see Section 3.2) in the context that municipal, industrial, agricultural and other discharges should be:

- free from substances in concentrations or combinations which are acutely toxic or may be harmful to human, animal or aquatic life;
- free from substances that will settle to form putrescent or otherwise objectionable sludge deposits, or that will adversely affect aquatic life or waterfowl;
- free from debris, oil, grease, scum or other materials in amounts sufficient to be noticeable in the receiving water;
- free from colour, turbidity or odour-producing materials that would adversely affect aquatic life or waterfowl, significantly alter the natural colour of the receiving water, or directly or through interaction among themselves or with chemicals used in water treatment, result in undesirable taste or odour in treated water;
- free from nutrients in concentrations that create nuisance growths of aquatic weeds or algae or that results in an unacceptable degree of eutrophication of the receiving water; and,
- in addition to the above objectives, effluent discharged to surface waters should not utilize more than 30 percent of the assimilation capacity of the receiving waterbody when discharged via means of a diffused outfall, or more than 10 percent when discharged via a point source outfall. These design objectives should be utilized during the planning stages of projects involving effluent discharges. For purposes of determining the available assimilation capacity of a receiving waterbody, a flow rate equal to or less than the average seven-day low flow which occurs once in ten years (e.g. 7Q10), at the outfall area, generally should be used.

3.2 Guidelines for Effluent Mixing Zones

A mixing zone is a transitional area within a waterbody in which an effluent discharge is gradually assimilated into the receiving water. At the outer edge of the mixing zone the water quality should not be appreciably different from the water quality prior to the discharge of the effluent. The size of the mixing zone will be influenced by the difference in water quality between the effluent and the receiving waterbody and the volume of effluent relative to the receiving waterbody.

The effluent mixing zone guidelines are intended for application to larger surface waterbodies. However, they also have limited application to some intermittent streams and small lakes that have sufficient flow or volume of water, at least seasonally, to adequately assimilate periodic discharges of treated wastewater effluent.

The guidelines should be applied by proponents during the planning and design stages of new developments involving effluent discharge(s) or changes in the flows/volumes of water available for effluent assimilation, and for current dischargers where alterations of the existing wastewater treatment or disposal system are proposed. These guidelines prescribe the general characteristics that mixing zones should or should not possess.

Specific Effluent Mixing Zone Guidelines

- the mixing zone should be as small as practicable and should not be of such size or shape as to cause or contribute to the impairment of existing or likely water uses;
- the existing General Objectives for Effluent Discharges (Section 3.1) should be achieved at all sites within the limited use zone;
- the limited use zone in streams and rivers should be apportioned no more than 25 percent of the cross-sectional area or volume of flow, nor more than one-third of the river width at any transect in the receiving water during all flow regimes which equal or exceed the 7Q10 flow for the area. Surface water quality objectives **applicable to the area** must be achieved at all points along a transect at a distance downstream of the effluent outfall to be determined on a case-by-case basis;
- in lakes and other surface impoundments, surface water quality objectives applicable to that waterbody must be achieved at all points beyond a radius of 100 metres from the effluent outfall. The volume of limited use zones in lakes should not exceed 10 percent of that part of the receiving waters available for mixing;
- the mixing zone should be designed to allow an adequate zone of passage for the movement or drift of all stages of aquatic life; specific portions of a cross-section of flow or volume may be arbitrarily allocated for this purpose;
- mixing zones should not interfere with the migratory routes, natural movements, survival, reproduction, growth, or increase the vulnerability to predation, of any representative aquatic species, or endangered species;
- mixing zones should not interfere with fish spawning and nursery areas;
- when two or more mixing zones are in close proximity, they should be so defined that a continuous passageway for aquatic life is available;
- when two or more mixing zones overlap the combination of the effluent plumes should not result in unacceptable synergistic or antagonistic effects on aquatic life or other water uses downstream of the mixing zone(s);
- mixing zones should not cause an irreversible organism response or attract fish or other organisms and thereby increase their exposure period within the zone;
- the 96 hr LC_{50} toxicity criteria, for indigenous fish species and other important aquatic species should not be exceeded at any point in the mixing zones;
- mixing zones should not result in contamination of natural sediments so as to cause or contribute to excursions of the water quality objectives outside the mixing zone;
- mixing zones should not intersect domestic water supply intakes, bathing areas or other sensitive designated use areas;
- specific numerical water quality objectives may be established by the Department for such variables or constituents thought to be of significance within the effluent mixing zone; and,

- defining the effluent mixing zone may need to be done on a case-by-case basis, in consultation with the Department, particularly where effluent is discharged into smaller waterbodies (i.e. streams and small lakes).

4.0 Surface Water Quality Objectives

The specific objectives presented below provide a means for evaluation of water quality conditions except in areas of a waterbody in close proximity to wastewater outfalls. In the vicinity of outfalls a "zone of passage" of satisfactory quality must be considered for aquatic biota travel. In waters of superior quality, impairment to the objective levels will not be acceptable.

4.1 Aquatic Life

Objectives for protecting the quality of the habitat of aquatic organisms are often more stringent than those applicable to other water uses. These objectives (**Table 4.1**) will afford a reasonable degree of protection of fish and other aquatic life at all stages of development. Because of the relatively stringent values for various constituents these objectives will also likely afford protection to wildlife, which rely upon surface water for drinking water and for their source of food supply.

Since the release of ***Canadian Water Quality Guidelines*** (CCREM, 1987), it has been recognized that water quality objectives for some persistent, bioaccumulative substances such as PCBs, toxaphene and DDT have a high level of scientific uncertainty and limited practical management value, and are therefore no longer recommended. For these substances, it may be more appropriate to use the respective tissue residue objectives and/or sediment quality objectives.

Table 4.1 Surface Water Quality Objectives for the Protection of Aquatic Life (modified from CCME 1999)

Parameter	Objective*	Comments
Aluminum	5 - 100	See Note 1
Ammonia (in mg/L)	--	See Table 4.1.1
Arsenic	5	
Bromoxynil	5	
Cadmium	0.017 – 0.10	See Note 2
Chlorine	0.5	
Chlorpyrifos	0.0035	
Chromium VI	1	
Copper	2 - 4	See Note 3
Cyanide	5	
Dicamba	10	
Diclofop-methyl	6.1	
Dimethoate	6.2	
Glyphosate	65	
Iron	300	
Lead	1 to 7	See Note 4
Lindane	0.01	
Mercury (inorganic)	0.026	
Nickel	25 - 150	See Note 5
Oxygen, Dissolved (in mg/L)	5.5 - 9.5	See Note 6
Pentachlorophenol	0.5	
Phenols (mono- and dihydric)	4	
Phenoxy Herbicides (2,4-D)	4	
Picloram	29	
Selenium	1	
Silver	0.1	

Temperature	Narrative Statement	See Note 7
Triallate	0.24	
Trifluralin	0.20	
Uranium	15	See Note 8
Zinc	30	

*All values in micrograms per litre (ug/L) unless otherwise indicated

Note 1: Aluminum Objective: 5 ug/L at pH <6.5, Ca <4 mg/L and DOC <2 mg/L; 100 ug/L at pH ≥ 6.5, Ca ≥ 4 mg/L and DOC ≥ 2 mg/L

Note 2: Cadmium Objective: 0.017 ug/L where hardness is 0 - 48.5 mg/L; 0.032 ug/L where hardness is 48.5 - 97; 0.058 where hardness is 97 - 194; 0.10 ug/L where hardness is >194

Note 3: Copper Objective: 2 ug/L where hardness is 0 - 120 mg/L; 3 ug/L where hardness is 120 - 180 mg/L; 4 ug/L where hardness is >180 mg/L.

Note 4: Lead Objective: 1 ug/L where hardness is 0 - 60 mg/L; 2 ug/L where hardness is 60 - 120 mg/L; 4 ug/L where hardness is 120 - 180 mg/L; 7 ug/L where hardness is >180 mg/L

Note 5: Nickel Objective: 25 ug/L where hardness is 0 - 60 mg/L; 65 ug/L where hardness is 60 - 120 mg/L; 110 ug/L where hardness is 120 - 180 mg/L; 150 ug/L where hardness is >180 mg/L.

Note 6: Dissolved Oxygen Objective: 6.0 mg/L for warm-water biota in early life stages; 5.5 mg/L for warm-water biota in other life stages; 9.5 mg/L for cold-water biota in early life stages; 6.5 mg/L for cold-water biota in other life stages.

Note 7: Temperature Objective: Thermal additions should not alter thermal stratification or turnover dates, exceed maximum weekly average temperatures, nor exceed maximum short-term temperatures.

Note 8: The objective was developed by the Industrial, Uranium and Hardrock Mining Unit of Saskatchewan Environment.

Table 4.1.1 Surface Water Quality Objectives for Total Ammonia for the Protection of Aquatic Life* (from CCME 1999)

Temp °C	PH							
	6.0	**6.5**	**7.0**	**7.5**	**8.0**	**8.5**	**9.0**	**9.5**
0	231	73.0	23.1	7.32	2.33	0.749	0.250	0.042
5	153	48.3	15.3	4.84	1.54	0.502	0.172	0.034
10	102	32.4	10.3	3.26	1.04	0.343	0.121	0.029
15	69.7	22.0	6.98	2.22	0.715	0.239	0.089	0.026
20	48.0	15.2	4.82	1.54	0.499	0.171	0.067	0.024
25	33.5	10.6	3.37	1.08	0.354	0.125	0.053	0.022
30	23.7	7.50	2.39	0.767	0.256	0.094	0.043	0.021

* in mg/L

Note: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The above values represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

4.2 Agricultural Uses

Surface water quality objectives for agricultural uses are shown in **Table 4.2**. Users of these objectives, such as resource managers and farmers, are reminded that these values are recommended concentration limits of contaminants in irrigation and livestock water; above these limits, possible harm to crops and livestock may result.

As far as irrigation is concerned, the two major factors to be considered when determining water's suitability for that use are salinity (measured by electrical conductivity or the concentration of Total Dissolved Solids) and the Sodium Adsorption Ratio or SAR. A plant's salt sensitivity is a function of many conditions including type of salt, conditions in the soil, water quality and climate. High SAR levels, meaning excess sodium relative to calcium and magnesium, can negatively impact soil structure by dispersing clay aggregates thus reducing soil permeability and aeration. Since different soils and plant species vary considerably in the quality of water each may tolerate, irrigators are advised to contact the Irrigation Development Branch, Saskatchewan Agriculture and Food in Outlook, Saskatchewan

(telephone 306-867-5528) for guidance regarding site-specific irrigation and cultural practices that would be best suited to the soil types and quality of waters available to them.

Livestock, depending upon the species, stage of development, quality of diet and rearing conditions, have different requirements and tolerances to various levels of constituents in waters supplied to them for consumption. The objectives presented in **Table 4.2** are intended to afford protection to most livestock species as well as to the consumers of products derived from these livestock.
Higher concentrations of constituents addressed in these objectives may be tolerated by some livestock species or by adult animals conditioned to such levels. For instance, higher salt concentrations than the objective level for TDS of 3000 mg/L may be tolerated by some livestock species. In such situations where the quality of water available for livestock watering does not meet the objectives livestock producers are advised to contact their local veterinarian for advice.

Table 4.2 Surface Water Quality Objectives for Agricultural Uses* (CCME 1999)

Parameter	Irrigation	Livestock	Comment
Aluminum	5000	5000	
Arsenic	100	25	
Beryllium	100	100	
Blue-green algae	--	Avoid heavy growth	
Boron	500 - 6000	5000	See Note 1
Bromoxynil	0.33	11	
Cadmium	5.1	80	
Chloride (in mg/L)	100 - 700	--	See Note 2
Chromium VI	8	50	
Cobalt	50	1000	
Coliforms, fecal (*E.coli*)	100 per 100mL	--	
Coliforms, total	1000 per 100mL	--	
Copper	200 - 1000	500 - 5000	See Note 3
Dicamba	0.006	122	
Diclofop-methyl	0.18	9	
Fluoride (in mg/L)	1	1 - 2	See Note 4
Glyphosate	--	280	
Iron	5000	--	
Lead	200	100	
Lindane	--	4	
Lithium	2500	--	
Manganese	200	--	
Mercury	--	3	
Molybdenum	10 - 50	500	See Note 5
Nickel	200	1000	
Nitrate + Nitrite (in mg/L)	--	100	
Phenol	--	2	
Phenoxy herbicides (2,4-D)	--	100	
Picloram	--	190	
Selenium	20 - 50	50	See Note 6
Sulphate (in mg/L)	--	1000	
Total Dissolved Solids (in mg/L)	500 - 3500	3000	See Note 7
Triallate	--	230	
Trifluralin	--	45	
Uranium	10	200	
Vanadium	100	100	
Zinc	1000 - 5000	50,000	See Note 8

*all values in micrograms per litre (ug/L) unless otherwise indicated.

Note1: Boron Objective: 500 ug/L for blackberries; 500 - 1000 ug/L for peaches, cherries, plums, grapes, cowpeas, onions, garlic, sweet potatoes, wheat, barley, sunflowers, mung beans, sesame, lupins, strawberries, Jerusalem artichokes, kidney

beans, lima beans; 1000 - 2000 ug/L for red peppers, peas, carrots, radishes, potatoes, cucumbers; 2000 - 4000 ug/L for lettuce, cabbage, celery, turnips, Kentucky bluegrass, oats, corn, artichokes, tobacco, mustard, clover, squash, muskmelons; 4000 - 6000 ug/L for sorghum, tomatoes, alfalfa, purple vetch, parsley, red beets, sugar beets; 6000 ug/L for asparagus.

Note 2: Chloride Objective: 1) Foliar damage: 100 - 178 mg/L for almond apricots, plums; 178 - 355 mg/L for grapes, peppers, potatoes, tomatoes; 355 - 710 mg/L for alfalfa, barley, corn, cucumbers; >710 mg/L for cauliflower, cotton, safflower, sesame, sorghum, sugar beets, sunflowers. 2) Rootstocks: 180 - 600 mg/L for stone fruit (peaches, plums, etc.); 710 - 900 mg/L for grapes. 3) Cultivars: 110 - 180 mg/L for strawberries; 230 - 460 mg/L for grapes; 250 mg/L for boysenberries, blackberries, raspberries.

Note 3: Copper Objective: 1) Crops: 200 ug/L for cereals; 1000 ug/L tolerant crops. 2) Livestock: 500 ug/L for sheep; 1000 ug/L for cattle; 5000 ug/L for swine and poultry.

Note 4: Fluoride Objective: 1.0 mg/L if feed contains fluoride.

Note 5: Molybdenum Objective: 50 ug/L for short-term use on acidic soils

Note 6: Selenium Objective: 20 ug/L for continuous use; 50 ug/L for intermittent use.

Note 7: Total Dissolved Solids Objective: 500 mg/L for strawberries, raspberries, beans, and carrots; 500- 800 mg/L for boysenberries, currants, blackberries, gooseberries, plums, grapes, apricots, peaches, pears, cherries, apples, onions, parsnips, radishes, peas, pumpkins, lettuce, peppers, muskmelons, sweet potatoes, sweet corn, potatoes, celery, cabbage, kohlrabi, cauliflower, cowpeas, broad beans, flax, sunflowers, corn; 800 - 1500 mg/L for spinach, cantaloupe, cucumbers, tomatoes, squash, Brussels sprouts, broccoli, turnips, smooth brome, alfalfa, big trefoil, beardless wild rye, vetch, timothy, crested wheat grass; 1500 - 2500 mg/L for beets, zucchini, rape, sorghum, oat hay, wheat hay, mountain brome, tall fescue, sweet clover, reed canary grass, birds foot trefoil, perennial ryegrass; 3500 mg/L for asparagus, soybeans, safflower, oats, rye, wheat, sugar beets, barley, barley hay, tall wheat grass.

Note 8: Zinc objective: 1000 ug/L when soil pH < 6.5; 5000 ug/L when soil pH > 6.5

4.3 Recreation and Aesthetics

Recreational water refers to surface waters that are used primarily for activities in which the user comes into frequent direct contact with the water, either as part of the activity or incidental to the activity. Examples include swimming, water skiing, bathing and wading. Secondary recreational uses include boating, fishing and canoeing, which generally have less frequent body contact with water.

The objectives shown in **Table 4.3** deal mainly with potential health hazards related primarily to recreational water use, but also relate to aesthetics and nuisance conditions. They should afford reasonable protection of water users from waterborne disease and maintain desirable aesthetic conditions in the waterbody.

Although the use of surface waters for personal drinking water supply is not addressed in this document, recreational water users are cautioned not to consume surface waters without prior disinfection (e.g. boiling, chlorination). Even waters that appear to be pristine may contain naturally occurring disease-causing microorganisms.

Table 4.3 Surface Water Quality Objectives for Recreation and Aesthetics (modified from CCME 1999)

Parameter	Objective
E. coli	The geometric mean of at least five samples taken during a period not to exceed 30 days should not exceed 2000 *E. coli* per litre. Resampling should be performed when any sample exceeds 4000 *E. coli* per litre.
Blue-green algae	Limits have not been specified. Health Canada is in the process of developing a numerical objective for microcystin, an algal toxin. Water with blue-green surface scum should be avoided because of reduced clarity and possible presence of toxins.
Temperature	The thermal characteristics of water should not cause an appreciable increase or decrease in the deep body temperature of bathers and swimmers
Clarity	The water should be sufficiently clear that a Secchi disc is visible at a minimum of 1.2 metres.
Turbidity	A limit of 50 Nephelometric Turbidity Units (NTU) is suggested.
Oil and grease	Oil or petrochemicals should not be present in concentrations that: • can be detected as a visible film, sheen, or discoloration on the surface; • can be detected by odour; or • can form deposits on shorelines and bottom deposits that are detectable by sight and odour.

Aquatic plants	Bathers should avoid areas with rooted or floating plants; very dense growths could affect other activities such as boating and fishing.
Aesthetics	All water should be free from: • materials that will settle to form objectionable deposits; • floating debris, oil, scum, and other matter; • substances producing objectionable colour, odour, taste, or turbidity; and • substances and conditions or combinations thereof in concentrations that produce undesirable aquatic life.

5.0 Saskatchewan Water Quality Index

An integral part of any environmental monitoring program is the reporting of results to both water managers and the general public. This poses a particular problem in the case of water quality monitoring because of the complexity associated with analyzing a large number of measured variables. One solution to this problem is to reduce the multivariate nature of water quality data by employing an index that will mathematically combine all water quality measures and provide a general and readily understood description of water. An index is a useful tool for describing the state of the water column, and for ranking the suitability of water for use by humans, livestock, crops, aquatic life, etc.

Saskatchewan has adopted its version of the ***Water Quality Index*** (WQI) from the ***Canadian Water Quality Index*** (CWQI), recently developed by the CCME Water Quality Index Technical Subcommittee. In addition to rating the suitability of provincial waterbodies for their potential uses, the *Index* will be used in Saskatchewan as a performance measure to gauge progress towards the goal of ensuring that watersheds are protected, natural purification and protection processes are maximized, and potential for contamination is minimized.

The WQI formula incorporates three elements: *scope* – the number of variables that do not meet the ***Saskatchewan Surface Water Quality Objectives***; *frequency* – the number of times these objectives are not met; and, amplitude – the amount by which the objectives are not met. The WQI produces a number between 100 (best water quality) and 0 (worst water quality). The resulting Index categories, that is, Excellent (95 – 100), Good (80 – 94), Fair (65 – 79), Marginal (45 – 64) and Poor (0 – 44), can be used to assess water quality relative to its desirable state and to provide insight into the degree to which water quality is affected by human activity.

Instructions for calculating the WQI for a specific waterbody are available in the ***Canadian Water Quality Index User's Manual*** (CCME, 2001).

6.0 Potable Water Supply

The maintenance of good quality drinking water can be achieved both by protecting the raw water supply and by water treatment. It is possible to protect the raw water supply by means of pollution control measures that prevent undesirable constituents from entering the raw water and by good watershed management practices. A wide range of treatment technologies is available by means of which it is possible to produce acceptable drinking water from most raw water sources.

The surface water quality objectives presented in **Sections 4.1 to 4.3** above will assist in the protection of waters to be withdrawn and treated as a potable supply.

Treatment processes for drinking water should be selected to provide potable and aesthetically acceptable water to the users. For waterworks serving the public, the treated water quality should meet the current ***Saskatchewan Municipal Drinking Water Quality Objectives***. Untreated water should not be used for potable purposes.

Pharmaceuticals and personal care products in potable water are an emerging concern, however, little data exists in any country on their presence in treated drinking water. The Department will be working with its provincial and federal counterparts to address these issues. Minimizing the impact of these

compounds depends on proper usage and disposal of the products, proper source water protection through watershed management and provision of proper treatment and distribution systems for drinking water supplies.

7.0 Algae and Other Aquatic Nuisances

"Aquatic nuisances" are those aquatic plants and animals that are present in sufficient numbers to pose problems for people or animals using a particular waterbody or its surrounding environment. Recreational water uses, for example, may be limited by the presence of swimmers' itch, excessive weed growth or algae blooms. One of the most common aquatic nuisances in Saskatchewan surface waters is algae. Algae are tiny plants, most of which are microscopic in size. Although an important component of aquatic ecosystems, certain algae when overabundant can foul beaches and cause water to have an unpleasant colour, taste or odour. Also high densities of blue-green algae that occurs under bloom conditions in surface waters may result in sickness or death among livestock or pets that drink such water.

Various control measures to reduce or eliminate such nuisances as algae, aquatic weeds, leeches, swimmers' itch, and biting insects, are possible. However, aquatic nuisance control activities must be carried out in a manner that will not jeopardize public safety and/or aquatic or terrestrial fauna and flora. Prior to conducting such control activities approval must be obtained from Saskatchewan Environment.

The subject of aquatic nuisance identification, control measures, use of chemical/mechanical control, and approval requirements is described in detail in the publication, ***A Guide to Aquatic Nuisances and Their Control*** (Saskatchewan Environment and Resource Management, reprinted 1998).

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